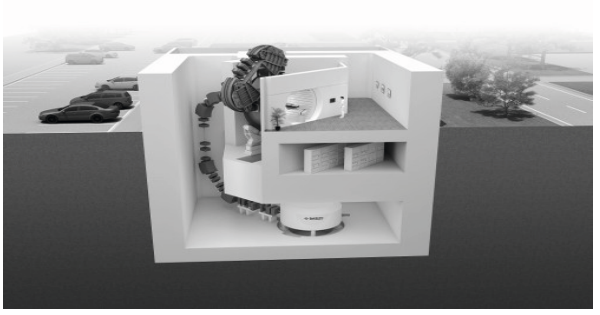
two set of orthogonal X-ray DR system for patient positioning, robotic couch, in-room CT, On-Line PET system for checking dose distribution in patient, respiration gating system for moving organ, and so on.



Results: Performance test is now underway and it has been confirmed that the proton beam of the energy range of 70MeV to 230MeV is successfully transported from the cyclotron to the treatment room. Various beam performance and dose distributions required for medical treatments are being acquired in early 2013, and medical treatment is expected to be started in 2013.
Conclusions: The world's first vertical layout proton therapy system has been developed and installed. Beam characteristics of both wobbling and pencil beam scanning irradiation are now being obtained. There results will be presented in this conference.

EP-1311
Digital analysis of MLC leaf position in static IMRT
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Purpose/Objective: To analyze the position error, gap error and the accuracy of fluence map between expected and derived multi-leaf collimator (MLC) position of static (step & shoot) intensity modulated radiotherapy (IMRT).
Materials and Methods: The treatment plans for 10 patients of nasopharyngeal carcinoma were enrolled. Each plan had seven beams with uniformly distributed angles (0°, 51°, 103°, 154°, 206°, 257° and 309°). For each patient and each beam, both planned MLC file (.mlc) from treatment planning system and actually derived Dynalog file (.dlg) from 4DTC station were collected for the first 10 fractions. Argus software (Varian V7.4.0.3) was used to load and quantitatively analyze the actually derived MLC leaf position from Varian 23EX medical linear accelerator during treatment. For each beam, errors of leaf positions, gaps and fluence maps were compared for both Bank A and Bank B.
Results: All the statistical results of 70 beams from 10 patients were summarized in the table below. The position errors of Bank A and B have similar absolute values but opposite directions, which were complementary to each other. Therefore, the gap errors were very small, where the maximum gap was smaller than 0.01cm. The position errors for beams at 103° and 257° (almost horizontal) were compared with beam 0° (vertical) respectively by paired T-test, where all the *p* values were bigger than 0.05 (difference were not significant).

	position error		Gap error		Fluence error
	all leafs	motive leafs	all leafs	motive leafs	
Bank A	0.031±0.008cm*	0.045±0.015cm	-	-	- 0.017%±0.031%
Bank B	-0.028±0.010cm	- 0.042±0.017cm	0.003±0.003cm	0.004±0.005cm	
Max.	<0.079cm		<0.010cm		- 0.178%±1.076%

* average ± standard deviation

Conclusions: Based on the latest standard from report TG142 that 'Leaf position accuracy for IMRT<1mm', this study proposed that the 60 pairs of MLC leafs in Varian 23EX provide acceptable position accuracy and good repeatability. The T-test results between 0° and horizontal beams proposed that the gantry angle didn't affect the leaf position accuracy significantly. The small fluence errors ensured the dose distribution accuracy and reliability between expected (plan) and executed (delivery) IMRT process.

EP-1312
Intraoperative technique versus whole breast radiotherapy : cost analysis from the hospital and societal viewpoint
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Purpose/Objective: Therapeutic strategies are usually evaluated on the basis of feasibility, clinical effectiveness and safety. More recently due to the limitation of resources the importance of economic factor has been stressed. Targeted intraoperative radiation therapy (IORT) has been described as an alternative to whole breast irradiation (WBI) for patients with early-stage breast cancer. The randomized phase III TARGIT trial has proved the equivalence of the two techniques in terms of recurrence rates and a lower overall toxicity profile in favor of IORT so that we are legitimate to perform a comparison in term of cost minimization analysis (CMA) . The aim of the study is to estimate resources and infrastructures cost necessary for economic evaluations following the Activity Based Costing (ABC) methods .
Materials and Methods: According to the ABC approach we defined all the activities in the treatments. We assigned a cost to every activities module measuring the work times required by the various professional groups involved in IORT and WBI treatments. The exact times of attendance of the different occupational groups and the room occupancies for any core procedures of radiotherapy were prospectively documented. Data for 50 IORT and WBI were collected and subsequently statistically analyzed. A questionnaire has been administered to all patients to asses the indirect costs for every treatment modality like transports, lost of production and assistance fees.
Results: From the hospital point of view data provide a cost benefit ratio in favor of IORT. Operating room occupancy is quite similar in contrast to the staff attendance time.
Definition of the target volume is the most time consuming procedure for the physicians taking 1 h on average. Medical doctors attends 60 min e 85 min in IORT a WBI respectively. The major differences related to the presence of technicians. It has a mean value of 58 min in IORT while for routine radiotherapy sessions the overall time, including CT acquisition, set-up verification and daily treatment is 410 min. Evaluated time will be converted in economic value. As questionnaires are being evaluated societal impact data are not still available.
Conclusions: The data presented here allow a cost comparison between IORT and WBI. Economic evaluations seems to be in favore of the IORT though one has to be aware that a comprehensive economic evaluation needs to consider the work load for every machine.

EP-1313
Feasibility of single-isocenter intensity modulated radiosurgery for multiple brain metastases
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Purpose/Objective: To assess the dosimetric feasibility to perform intensity modulated radiosurgery (IMRS) of multiple brain metastases by using fixed beams and a single isocenter.
Materials and Methods: Five cases of patients with multiple brain metastases (range from 4 to 19) were planned using Eclipse TPS (v 10.0) and the AAA algorithm (1.0 mm calculation grid). For each case, a single isocenter was used with several coplanar beams (range 12–18) with fixed gantry angles. Delivery was done using a Varian Clinac 2100 CD equipped with a Millennium 120 MLC (5 mm width on the central leaves) and an EPID (aSi 500). The sliding-window technique with dose rate of 600 MU/min was used in all IMRS deliveries. The patient-related IMRS quality assurance was performed using three strategies: 1) fluence verification of each beam was done using portal dosimetry with the EPID and the PDIP algorithm (v 10.0) of EclipseTPS. Measured fluences were compared to predicted ones using 4%-1 mm gamma criteria. 2) Point absolute dose was checked in a high dose and low gradient region of a polystyrene phantom where the original patient plan was mapped. 3) Patient dose reconstruction was performed by using the Dynalog files registered during the irradiation of the phantom verification. An in-house program was developed by TT to generate the dynamic MLC from the Dynalog files. Original plan was compared with the Dynalog-based reconstructed one by using DVH data for the target and organs at risk outlined (brainstem, optic nerves and optic chiasma) on each patient case.
Results
1) The average gamma passing rate was 98.5% for the 80 IMRS fields analysed using 4%-1 mm criteria.